

W6IFE Newsletter

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The 6 June meeting will have our new president talking about the ARRL Design software. SBMS meets at the American Legion Hall 1024 Main Street Corona CA at 1930 hours local time.

Last Meeting Discussion was held on the FCC plans to use part of the 5 GHz ham band for an unlicensed SUPERNET Device band with equipment from Motorola and Apple. Dave WA6OWD will be providing SBMS comments to FCC. Treasurer George was approved to move the Society bank account to Lockheed Credit Union and add Dick K6HIJ as alternate signer to the account. John WA6BFH, SBMS rep to Inland Empire Radio Council, reported that the Society was requested to provide some funding to move the SW Division ARRL Conference to Riverside. The membership voted to provide \$10/person in addition to participate in tech talks and demos. Members are making plans to be out in the June contest on 2 Ghz and up. Phil W6HCC was out to the Loma Linda ARC to demo and talk about amateur microwave. The parking lot patrol continues at the meetings. 22 people present.

Welcome to new members; Peter Kofler IN3GHZ Sudtiro, Italy; Gordon West, WB6NOA; Peter Von Hagen WA6HXM Palos Vedes Estates.

Words from the Pres.:

The Four Seasons: Winter, Spring, Microwave and Fall Summer is a special time for microwave enthusiasts. Mountain roads and summits are open and our western high pressure systems provide the temperature inversions which carry our small signals great distances. The summer's desert and valley heat becomes a cool breeze at 8000' and you can see forever on a clear day. This is the time of year to get out and make some contacts. Anyone considering getting into microwaves should take the time to get up to one of the many local operating sites during an upcoming contest or weekend outing and see what all the fun is about!

When I first joined the SBMS in the 70's, I enjoyed the technical discussions and the chance to learn from the experts, but it wasn't until I followed Chuck and Phil up to Heaps Peak many years later did I realize where the fun REALLY was. There is nothing like a microwave contact, one that you really have to work at. Anyone who's made one knows that's its special. Its what we do. It doesn't come easy however. It takes work and you have to want to do it. I can almost guarantee that most of us didn't make a contact on the first time out. I suppose that adds to the excitement when you finally hear that first carrier down in the noise and move the antenna around to peak it up. The eventual contact might only be 20 or 30 miles but it actually works and YOU built it! Its a special moment and I guarantee everyone who's been there can tell you who they first worked what radio they were using.

Many SBMS members are working towards this first contact now. Soon they'll know what I'm talking about and you'll see that look in their eyes too. If you've been coming to the SBMS meetings and still don't get it, here's your chance. Come up the mountain this summer. Watch the process and ask a lot of questions. Operate one of the radios and tweak the dish on a wispy CW signal coming 300 miles down from Northern California. Listen to two different signals coming from one distant station as you find the direct path plus Doppler shift off an airplane 100 miles away. Hear a 40/S9 signal coming 400 miles over water up from Mexico. Find the beacons your fellow hams have built to help you find your frequency and beam headings. Learn how

the weather, the rising sun and pancakes for breakfast can make a difference. Get sunburnt and frostbitten at the same time. Then, come down from the hill and start planning your own radio. It might take a two or three years to build, but its worth it. Come out and join us on a hill this summer. Find out why we REALLY do this.

Frank WB6CWN

Scheduling

6 June Chuck WA6EXV Noise Figure Measurement session 2 mtr, 70 cm, 30 Mhz IF.

8 June VHF QSO party

22 June Field Day

6 July Picnic at Craig Park in Fullerton, CA, entry fee \$2-3, see Dick WB6DNX

1 August George K6MBL scanned and copies of SBMS historical images

3-4 Aug. UHF contest

5 Sept. TBD

3 Oct. Dick K6HIJ RF component design

June Contest Microwave Active Sites

Frank WB6CWN DM08 2 mtr, 2 & 10 Ghz, Gordon WB6NOA/MM CM92 10 Ghz; Chuck WA6EXV, DM15DP 2, 3, 5, 10 Ghz Sat and at DM08 sun; Brian KD6LI Loma Prieta ranch 2, 10 GHZ; Phil W6HCC on Heaps & Keller Pks DM15KF/LE 2-10 Ghz ; Jim NW7O Mt. Ella DM27; Jack N6XQ on Island DM02 10 Ghz with other on lower bands; N6IZW/WB6IGP on Soledad late Saturday afternoon. W6OYJ on Mt. Laguna Saturday and Soledad Sunday. N6IZW and WB6IGP will have 10 GHZ and 2.3/3.4 GHZ rigs available. W6OYJ only 10 Ghz. KC6UQH on Santa Rosa and N6RE Santa Ynez with 10 GHZ ATV only. Liaison plans; 144.2+/- Mhz SSB.

San Bernardino Microwave Society is a technical amateur radio club affiliated with the ARRL having a membership of over 100 amateurs from Hawaii to the east coast. Dues are \$15 per year which includes a badge and monthly newsletter. Your mail label indicates your call followed by when it is time to renew your dues. Dues can be sent to the treasurer as listed under the banner on the front page. If you have material you would like in the newsletter please send it to Bill WA6QYR at 247 Rebel Road Ridgecrest, CA 93555, WA6QYR@WA6YBN.SOCA.CA.USA, bburns@ridgecrest.ca.us, or phone 619-375-8566. The newsletter is generated about the 15th of the month and put into the mail at least the week prior to the meeting.

Activity Reported at the May meeting

Bob, W6SAY has some Qualcomm 10 Ghz transverter boards.

Ken, WB6DTA has some bricks for LO.

Dick, WB6DNX has beacon for Santiago operating now with 300 mw on 10265. Will be adding voice and MCW ID.

Derek KN6TD designing boxes for Down East 10 Ghz rig.

Joe WA6PAZ did a great talk at the West Coast VHF conference.

Dick K6HIJ designing some directional couplers.

George K6MBL still looking for more photos for the August talk.

John W6VYS has a satellite receiver.

Al KF6YM reported that there is a 2w 3480 Mhz beacon on Santiago Pk.

Matt, KE6ALM ordered an 18 inch dish and materials for a rig.

John WA6BFH has been talking at many clubs, and is looking for 10 Ghz talk for the ARRL 97 convention in Riverside and some demos.

Chip N6CA has been working on a tower, mods to TS-850, new 1200 Mhz antenna.

Phil, W6HCC doing windows programming and Loma Linda ARC talk.

Dave WA6OWD QSO on 3456 Mhz with W6HCC.

Chuck, WA6EXV working on drive motors of dish and antenna range. Has surplus parts for 3456 Mhz TVRO RF amp , they need 1st stage device.

Stuart K6YAZ went to the land mobile show in Vegas. Much demand for spectrum.

Area reports- NORCAL

From: jpawlan@pawlan.com (Jeffrey Pawlan) "50 Mhz and Up Group"
Good news! We definitely have the Lockheed auditorium (bldg 202) again for our next meeting which will be as previously announced on Saturday, May 18, at 1:00pm sharp.

This is in Palo Alto off of Hanover St. which is accessible from Page Mill Road.

Sorry about the conflict with Dayton, but we could not find a better date. The program will consist of:

1. Brian Yee leading a discussion on contesting, mountain toping, and field day.
2. I will give a tutorial on VSWR: what is it, how is it measured at VHF, UHF, and microwave, and what is its effect on transmission and on weak signal reception.
3. We will have a low-key informal members-only swapmeet for VHF, UHF, and microwave items.

The meeting of the VHF, UHF, Microwave Experimenter's Club of N. Calif. was held in Palo Alto yesterday (May 18) with about 33 people in attendance. The lower attendance was due to some hams being at Dayton and some getting ready for a VHF sprint. The membership voted to change the name to: "The 50 MHz and Up Group" and the Newsletter, which will be put on the web later will be: Dirty Dishes The minutes will be posted in the next week and the http address will be sent to all of you when it is ready. I thank Brian Yee KD6LI, Jimmy Trebig W6JKV, Bob Magnani K6QXY, and Brad Wyatt K6WR for their contributions to the program. The up-to-date revised roster in printed form was available at the meeting for \$3.00 and there are 34 copies left, if you want one.

You can either pick one up from me or you can send me \$3.00 plus \$1 for postage and a manila envelope. Jim Moss is going to try to arrange the next meeting on Thurs, June 20 in Santa Clara at 7pm. We will send out email announcements when he has definite information. 73s,

Jeffrey Pawlan WA6KBL email: jpawlan@pawlan.com

14908 Sandy Ln. San Jose, CA 95124-4340

Thanks, Jim W6ASL

From: brian@compass.Ebay.Sun.COM (Brian Yee) Northern California Experimenter/
Microwave group Web page

There is a new Web page on Northern California activities at
http://www.nitehawk.com/rasmit/n_ca_uw1.html 73, KD6LI

May 1996 San Diego report

At the May 20 meeting of the SD Microwave Group, the following rigs were demonstrated by their owners: Jerry, WA6VLF: home-brew xcvrs for 2.3, 3.4, and 5.7 GHz, with Tx outputs of 2 mw, 10 mw, and TBD, respectively. Kerry, N6IZW: home-brew portable rig for 3.4 GHz with 5 dB NF and about +5 dBm output. Based on a Qualcomm synthesizer (different type than used for the 10 GHz conversions). Kerry used a cavity-backed spiral antenna. These have been showing up at the swap meets lately. They have an SMA connector. Measurements show better than 10-12 dB return loss over the 1-20+ Ghz range! Chuck, WB6IGP: similar 3.4 GHz rig with about 1 mw output. Chuck and Kerry

made a mobile-to-home station QSO before the meeting began. Chuck used a coaxial 3 band (WA3RMX type) antenna feed as his antenna. He has several of these stripline antennas available.

Ed, W6OYJ: demonstrated a 2.3 GHz receiving converter made of boards from an LMW Kit he assembled several years ago. The transmit portion of the kit proved impossible to complete, as the parts did not match the schematic, the schematic did not match the boards, and the boards did not match the assembly drawings. This converter was used in 1991? to receive the Heap's Peak beacon from High Point in SD County.

Art, KC6UQH demonstrated a new 36-inch dish obtained for him by N6RE. He is using a helix feed antenna with cup reflector for his X-band Amateur TV tests with N6RE.

Pete, W6DXJ is working on an WA6OWD phaselock board for his LO. He also is installing a new brick-based LO for his tower-mounted 10 GHz home station.

J, KD6PBH (That's how he spells his first name) picked up a DSS dish antenna and a TR Relay for his 10 GHz rig at the last swap meet.

73s from Ed

From: "Robert E. Munn" 75353.1255@CompuServe.COM Subject: W6IFE License Renewal Bug

Today I was surprised to receive the renewal licenses for both W6IFE and my own W6OYJ. It only took about two weeks!! There is a bug, however in the FCC's renewal setup for Club Licenses. The W6IFE license does not become effective until May 6, 2006.....but it expires on May 6, 2003!! So I have sent them a letter asking them to keep us in this Century for a few more years. Meanwhile, our previous license is in effect until August. 73s from Ed, W6OYJ>>

From: kbanke@qualcomm.com (Kerry Banke)

Last Monday at our San Diego Microwave Group meeting, Pete W6DXJ, Chuck WB6IGP, and I worked each other across the yard on 2304 MHz for the first time. The object was to get some of the pieces for this band (gathering dust) on the air. Yesterday Chuck went up to Mt. Helix & worked me from my home. although this was a whopping 3 mile contact, it did give us a basic shakedown. we are both running about +15-20 dBm into 30" dishes. We are experimenting with some of the cavity backed spiral antennas which are showing up at the surplus houses & flea markets. These are circularly polarized & we're attempting to use them as multiband feeds from 1.3-10 Ghz.

On our Sunday contact, I was able to insert about 50 dB of attenuation and still copy on FM so we'll do some calculations to see how the antenna gains & such are doing.

We're ready to do some hill topping & work some of the SBMS guys when you're ready.

We are using the Qualcomm synthesizers and mixers in these rigs & they seem to be doing a good job. There are plenty more available. Contact Chuck WB6IGP for more info on these. We have also been removing (mostly SMD) parts from scrap Qualcomm boards which might generate some interest. We have quantities of 2334 Dual DDS chips (30 Mhz clock) and compatible DACs, 3036 & 3216 1.6 GHz PLLs, .6-1.2 GHz VCOs, SBL1 mixers, a few SRA-11 mixers, 225 & 247 MHz 3 stage Toko Helical filters, 80 MHz A/D converters, Static RAM, Flash RAM, dual & quad UARTs, 21.4 MHz 40 KHz wide filters, 3356 FSK receiver ICs, tons of general CMOS SMD devices of all types, LM120,140,395 voltage regulators, 25 & 30 Mhz clock oscillators, Tantalum caps, resistor networks, 80186 Processors & lots more. Would there be any interest in doing some inter-group project (maybe laying out a DDS board) which we can assist in by supplying parts?

Just food for thought. At our May meeting we will be checking out 3456 Mhz equipment followed by 5760 MHz in June. Jerry, WA6VLF indicates his newly assembled 2.3 GHz rig copied the Heaps Peak beacon from Miguel in San Diego with a horn antenna (vertically polarized & FM modulation). At the May 20 SDMG meeting we expect to have W6OYJ on 2.3 GHz and WA6VLF, WB6IGP, and N6IZW on 2.3 & 3.5 GHz. Next month we'll be going for whatever we can assemble on 5.7 GHz (we have a few C-Band versions of the Qualcomm Omnitrac units with 4 watt PAs on which I'll be attempting a conversion).

Subject: San Diego X-Band Repeater coming down for Modifications

Jerry, WA6VLF & I anticipate taking down the San Diego X-Band repeater on Saturday May 11 for modifications. It will no doubt be out of service for a couple of months.

Both Miguel 10 GHz beacons will continue to function as they are independent of the repeater & are only somewhat amplified by it.

The repeater currently appears as two 13 dB omni antennas with 70 of amplifier gain between them. We hope to provide additional input/output isolation by increasing the antenna spacing from the current less than 10 feet to around 45 feet. I also suspect that the existing tubular fiberglass housing is causing some degradation by acting as every lossy waveguide along its length & causing coupling between the input & output antennas. This modification should allow us to increase the repeater gain by whatever additional amount of isolation we achieve. We will also be modifying the remote control system and changing where the variable attenuator is placed in the repeater amplifier chain. The current location of the voltage controlled attenuator is limiting the maximum output power to about 0.1 watt. Moving the attenuator away from the PA & more towards the LNA end of the system should enable the full 1 watt output capability. I'll keep you posted on our progress.

I also can provide an email version of the San Diego X-Band Repeater write-up I did for the West Coast VHF Conference Proceedings for those who are interested. Not too far in the back of my head is a multiband beacon to cover 2-10 GHz as a next project. 73 - Kerry N6IZW -

EAST From: Paul Wade N1BWT & Beth Wade N1SAI wade@tiac.net

preview the N1BWT 10 GHz home page at <http://www.tiac.net/users/wade>. suggestions welcome! 73 paul

I recently found a source for test equipment manuals at a fair price, for those of us who find old treasures at fleas:

Ed Matsuda Test Equipment Manuals PO Box 390613 San Diego, CA 92149 619-479-0225 FAX 619-479-1670 My orders to date had rapid response. Thanks to Ed Walker, WA4DFS, for finding this guy. paul N1BWT

Inland Empire- From: John Wendt <http://www.geocities.com/SiliconValley/2775/>

73 for now, CUL de John WA6BFH

World--Dr Barry Chambers, Dept of Electronic & Electrical Eng, University of Sheffield Mappin St Sheffield S1 3JD, U.K email: b.chambers@sheffield.ac.uk phone: + 44 (0)114 282 5588

Subject: Greetings from UK Microwavers

This note is to say hello from the RSGB Microwave Newsletter editors (Barry G8AGN and myself, Peter G3PHO) on behalf of all the microwave enthusiasts over here in the United Kingdom. A number of G stations with our common interest will be at Dayton this year...look out for them at the Radisson Hotel on Friday night. Our Microwave Newsletter is published monthly and consists of technical articles, when the readership send them to the editors :-), activity news (mainly Eu biassed) and component/equipment news.

It is a 12 to 16 page booklet and is published ten times a year, monthly with a bi-monthly issue around Christmas and the midsummer period. We would like to hear from microwavers from any part of the world. The subscription details can be obtained from the RSGB, Subscriptions Dept., Lambda House, Cranborne Road, Potters Bar, Herts., EN6 3JE, England. As yet we do not have a microwave web page....maybe some time in the future. We are always pleased to hear from visiting hams. We often see Gordon, WB6YLI, who comes over here from CA every summer to operate our 10ghz Cumulatives!

BTW has anyone got any information on the Digital Microwave Corporation 23 GHz modules type R11DM2003? They have become available on the ham "market" over here and produce about +16dB at their design frequency. They consist of a 2 x GaAsFET pa, a 2 x GaAsFET RX preamp/mixer, with IF at 1.2GHz and a DRO local oscillator. Many of us are trying to convert them for 24 GHz ssb/cw and would appreciate any circuits and other details technical information.

73 Peter G3PHO Co-Editor RSGB Microwave Newsletter QRV 1.8-30MHz, 144MHz, 1.3GHz, 10GHz, 24GHz

From: BARRY CHAMBERS B.Chambers@sheffield.ac.uk

Subject: Brick phase locked sources

I have a "brick" phase locked source using an internal 106.5MHz xtal and having an output frequency of 10224MHz (+144MHz = 10368MHz NB). I seem to recall seeing a similar oscillator some time ago which had no internal xtal oscillator but provision for feeding in an external signal (in my case at 106.5MHz). I would like to do this, using a synthesised source. Please can someone suggest what mods I need to make to the brick ?

73 from the UK, Barry G8AGN (RSGB Microwave Newsletter ed)

ARRL PACIFIC DIVISION UPDATE JUNE, 1996 by Brad Wyatt, K6WR, Director, Pacific Division, ARRL Pacific Division Home Page -- <http://www.pdarrrl.org/>

5725 - 5875 MHz Band is Threatened:-

On May 6, 1996, the FCC released a Notice of Proposed Rule Making, ET Docket 96-102, for a proposed wireless Internet called NII/SUPERNet. This proposed unlicensed service would occupy the 5725 - 5875 MHz segment of the 5650 - 5925 MHz Amateur Band.

A special Pacific Division 5725 - 5875 MHz Alert Team is already in place with all the information necessary to work with ARRL and Comment on the NPRM to help save the band. Comments are due in 60 days; Reply Comments in 90 days.

If there are any others interested in being part of this team, please contact me at my Internet address, above. The text version in ASCII format (no footnotes and without special formatting) is available via Internet. There are two parts to this bulletin; each part is about 45K bytes each. If you wish a Word Perfect or Word for Windows copy which contains special formatting and the footnotes, W6CF can e-mail you a zipped, UUencoded copy. Please note that the zipped, encoded WordPerfect and Word for Windows files are 105K bytes and 67K bytes in length, respectively. You'll need to decode and unzip the files before printing. Please contact w6cf@arrl.org if you wish this service.

FCC Cracks Down On 2-Meter Jammer - KB5UJD Yields Ham Ticket for Life:-

Irvin J. Foret, KB5UJD, of Metairie, LA, one of a group of hams cited for 2 meter interference in the New Orleans area, has agreed to immediately surrender his Amateur Radio license for life and permanently divest himself of all electronic equipment capable of transmitting on the ham bands. In addition, Foret has agreed to refrain for life from applying for any FCC license or permit, regardless of the service; from participating as a third party in any communication in the Amateur Radio service; and from transmitting on CB. Foret also agreed to pay \$500. In addition, Foret agreed to "cooperate fully and completely with all government officials in connection with any ongoing or future administrative or law enforcement investigations" or proceedings involving ham radio operations by others. Just maybe this is the beginning of FCC enforcement of rules. See editorial on page 9, June 1996 QST and page 77 June QST for more details.

"WANTS & GOTS FOR SALE"

The KD6PBH GPS display is a compact unit which shows latitude, longitude, UTC "zulu"

time, the number of satellites and the computed Maidenhead Grid Square location. As input, the unit takes a serial connection from a GPS receiver which outputs the standard NMEA GPGGA sentence and +9-15V power. Output is provided on an LCD display with 2 lines and 16 characters per line and LED backlight. The 6-character grid square computation is valid for any North American location.

The heart of the KD6PBH GPS display is an MC68HC705J1A microcontroller in a 20 pin DIP package. This receives the serial input, drives the LCD display module, and computes the grid square from the latlong. Other components include the smart LCD module, a serial receiver chip, on-board power regulator and LCD bias voltage generator. The RS-232 receiver chip has been shown to work with commercial GPS receivers (e.g., the Garmond 45) which can output GPGGA messages on their serial port. The unit consumes 12-15 mA with backlight off and roughly 50 mA with backlight on. Firmware for the micro is burned into on-board PROM. The kit includes all parts, a PC board, programmed microcontroller, instructions, and the LCD module.

Not included in the kit are the external cabinet and connectors for your application.

Several folks have used the blue plastic Radio Shack box measuring roughly 1.25 x 2.5 x 4.5 inches, with Molex and/or DB-9 connectors.

The kit costs \$45 including tax. Shipping is additional, and will vary with the method you prefer. You can reserve a kit by writing email to j@harper.com, calling 619.693.9046, or even sending USMail to J Goldberg Harper Technologies P.O. Box 26910 San Diego, CA 92196-0910

To order, please send a check to the above address. (At this time, I cannot accept credit card orders.) Please allow 2-4 weeks for delivery. However, if you have reserved a kit in advance, your order will be given priority and filled more quickly (and often from stock within a couple of days).

ORDERING CRYSTALS FOR PHASE-LOCKED OSCILLATOR BRICKS----N1BWT Jan 1994

There may be cheaper places, but all the crystals I've gotten from International Crystal (800-426-9825) have worked. For 10 GHz bricks, specify Catalog No. 585155 and the crystal frequency. This number is for a Frequency West MS-76, but should work for all the bricks made to the same Collins spec. For 6 GHz bricks, specify Catalog No. 585132 and the crystal frequency. This number is for a Frequency West MS-54, but should work for all the bricks made to the same Collins spec. You will also be asked if the crystal is ovenized - most of the ones with an internal oscillator are, but you should look. The oven is a little metal housing around the crystal with a transistor bolted to one side as the heater.

There is also a cover over the crystal, either black rubber or aluminum. Current price is \$18.45 each, with about one month delivery. Minimum order is \$35, so pooling orders to buy at least two is a good idea.

CRYSTAL FREQUENCY The 10 GHz bricks multiply the crystal by 108, so divide your desired LO frequency by 108.

The 6 GHz bricks multiply the crystal by 60, so divide your desired LO frequency by 60. The 4 GHz bricks multiply the crystal by 39, so divide your desired LO frequency by 39. All of the bricks I've ever seen are above the respective ham bands, so I strongly recommend using high side LO injection. The frequency will tune backwards and the IF radio will need LSB to run USB on the microwave band, but your frequency calibration is never going to be exact anyway. The frequency after multiplication will be off by as much as 50 KHz, so plan for this when you select the frequency. I don't know if you can pull the crystal frequency anyway - I prefer to peak the oscillator and have it stable. Once the oven warms up, these oscillators are as stable as the average 2 meter transceiver.

The bricks have an output interdigital filter. Most are tuned significantly above the ham band, so they will provide an LO for a 432 MHz IF but not a 144 MHz IF without retuning. Retuning is best done with a spectrum analyzer; if you are intent on doing it, check with me for suggestions. LO calculation example (ones I have

used):

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10368.1 + 432.2 = 10800.3, divide by 108 = 100.002778 MHz
10368.1 + 144.2 = 10512.3, divide by 108 = 97.336111 MHz
5760.1 + 432.2 = 6192.3, divide by 60 = 103.205 MHz
5760.1 + 144.3 = 5904.4, divide by 60 = 98.406667 MHz
3456.1 + 432.2 = 3888.3, divide by 39 = 99.700000 MHz
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Note that an IF of 144.2 MHz or 432.1 MHz puts you in danger of having IF feedthrough problems during a contest - a problem I've suffered with. My choices are limited by the limited tuning range of my IC202 and IC402. If you have a fancy multimode radio, you have a wider choice, but be careful. If you are going mountaintopping, repeater outputs start about 144.5, and packet stations around 145 MHz can provide constant noise - both can leak through and drive your IF radio crazy.

(PS - bypass caps AND ferrite beads on your power, mike, and key leads will help with strong TV and FM stations on many mountaintops.)

INSTALLING THE CRYSTAL The crystals are in a metal transistor can (TO-5). When you remove the old crystal, note that it has an insulator under the can with holes for the leads - save this and use it with the new one. New crystals have excessive lead length, which can short out inside (intermittently, of course). Cut the leads to the same length as the old crystal (around 1/4 inch) VERY carefully - if you shock the crystal, you might as well throw it away.

Hold the lead with a pair of needlenose pliers between the can and the cutters to absorb the shock. Finally, hold the crystal with needlenose pliers and slip it into the socket -it may take a few tries to line up the pins, but don't force it and bend the pins (practice with the old crystal might help). Replace the spring clip, oven cover, and cover plate.

TUNEUP Apply -19 or -20 volts as marked (the -20 volt units have an internal series diode for reverse voltage protection - not a bad idea). Connect a DC voltmeter from the "XTAL" terminal to ground and adjust the "REF ADJ" for maximum indication. Check the crystal frequency at the "REF MON" connector with a frequency counter - if it's an oddball connector, shove a piece of wire in to get a reading. Now connect an oscilloscope from the phase terminal (may be marked with Greek letter phi) to ground.

There is probably a square wave present - that is the phase-lock circuit searching for the oscillator. Adjust the "CAVITY TUNE" adjustment gently (easy to break plastic shaft) until the square wave disappears and a DC voltage is present - the oscillator is now phase-locked. Adjust it back and forth to center the tuning in the lock range. If you have a frequency meter, check the output frequency to make sure it is locked to the right harmonic; if not, tune the cavity to a different lock point.

Power output should be at least 10 milliwatts - if much less, the interdigital filter needs retuning. If mountaintopping in New England is contemplated, you might want to seal the brick in a ziplock bag, put it in the refrigerator for a few hours, then take it out and touch up the adjustments to be sure it will start cold. Some units have an "ALARM" terminal. This is a relay contact which closes if phase lock is lost; I've had it happen on cold mountaintops. Use it to light a warning LED.

73's, Bill